WHAT IS CLAIMED IS:

1. A device for providing environmental stability and mechanical integrity in space, the device comprising:

a substrate;

a first silicon oxynitride layer on the substrate, the first silicon oxynitride layer having a tensile stress;

a second silicon oxynitride layer on the first silicon oxynitride layer, the second silicon oxynitride layer having a compressive stress.

2. The device of claim 1 is free from delamination and cracking of the first silicon oxynitride layer and free from delamination and cracking of the second silicon oxynitride layer after at least 60 hours under a first UV radiation in a first vacuum condition.

3. The device of claim 2 wherein the first UV radiation has a first UV intensity equal to a second UV intensity of a second UV radiation received by a spacecraft in space.

4. The device of claim 3 wherein the first vacuum condition has a first vacuum pressure ranging from 1×10^{-6} torr to 1×10^{-3} torr.

5. The device of claim 1 is free from delamination and cracking of the first silicon oxynitride layer and free from delamination and cracking of the second silicon oxynitride layer after at least 3000 hours under a third UV radiation and a first electron and proton bombardment in a second vacuum condition.

6. The device of claim 5 wherein the first electron and proton bombardment has a first electron and proton intensity equal to a second electron and proton intensity received by a spacecraft in space.

7. The device of claim 6 wherein the third UV radiation has a third UV intensity equal to a fourth UV intensity of a fourth UV radiation received by the spacecraft in space.

8. The device of claim 7, wherein the second vacuum condition has a second vacuum pressure ranging from 1×10^{-12} torr to 1×10^{-7} torr.

9. The device of claim 1 wherein the tensile stress ranges from 0.01 MPa to 1 MPa.

10. The device of claim 9 wherein the compressive stress ranges from 10 MPa to 100 MPa.

11. The device of claim 1 wherein the substrate comprises at least one selected from a group consisting of polymer, ceramic, carbon composite, Kapton, black Kapton, aluminum, aluminum alloy, silver, gold, platinum, titanium.

12. The device of claim 1 wherein the first silicon oxynitride layer comprises SiO_xN_y, x ranging from 0 to 2, y ranging from 0 to $4/3$.

13. The device of claim 12 wherein the second silicon oxynitride layer comprises SiO_xN_y, x ranging from 0 to 2, y ranging from 0 to $4/3$.

14. A device for providing environmental stability and mechanical integrity in space, the device comprising:

a substrate;

a first coating layer on the substrate, the first coating layer having a tensile stress;

a second coating layer on the first coating layer, the second coating layer having a compressive stress;

wherein

the first coating layer is free from delamination and cracking and the second coating layer is free from delamination and cracking after at least 60 hours under a first UV radiation in a first vacuum condition, the first UV radiation having a first UV intensity equal to a second UV intensity of a second UV radiation received by a spacecraft in space, the first vacuum condition has a first vacuum pressure ranging from 1×10^{-6} torr to 1×10^{-3} torr.

15. A device having environmental stability and mechanical stability in space, the device comprising:

a substrate;

a first coating layer on the substrate, the first coating layer having a tensile stress;

a second coating layer on the first coating layer, the second coating layer having a compressive stress;

wherein the first coating layer is free from delamination and cracking and the second coating layer is free from delamination and cracking after at least 3000 hours under a first UV radiation and a first electron and proton bombardment in a first vacuum condition, the first electron and proton bombardment having a first electron and proton intensity equal to a second electron and proton intensity of a second electron and proton bombardment received by a spacecraft in space, the first UV radiation having a second UV intensity of a second UV radiation received by the spacecraft in space; the second vacuum condition having a second vacuum pressure ranging from 1×10^{-12} torr to 1×10^{-7} torr.

16. A device for providing environmental stability and mechanical integrity in space, the device comprising:

a substrate;

a silicon oxynitride coating layer on the substrate, the silicon oxynitride coating layer having a changing stress, the changing stress being compressive on a top surface of the silicon oxynitride coating layer and tensile on a bottom surface of the silicon oxynitride coating layer.

17. The device of claim 16, wherein the substrate comprises at least one selected from a group consisting of polymer, ceramic, carbon composite, Kapton, black Kapton, aluminum, aluminum alloy, silver, gold, platinum, titanium.

18. The device of claim 17, wherein the substrate comprises a reflective layer, the reflective layer reflecting solar radiation.

19. The device of claim 17 wherein the substrate comprises at least one selected from a group consisting of silver, aluminum, gold, platinum, and titanium.

20. The device of claim 16 wherein the silicon oxynitride coating layer comprises at least a first coating sub-layer and a second coating sub-layer, the first coating sub-layer on the second coating sub-layer, the first coating sub-layer having the compressive stress, the second coating sub-layer having the tensile stress.

21. The device of claim 20 wherein the first coating sub-layer has a first thickness ranging from 5 microns to 35 microns.

22. The device of claim 21 wherein the second coating sub-layer has a second thickness ranging from 0.5 micron to 5 microns.

23. The device of claim 22 wherein the first thickness equals 19.5 microns.

24. The device of claim 23 wherein the second thickness equals 2.5 microns.

25. The method for making a protection device, the method comprising:

depositing a first silicon oxynitride layer on a substrate using a first plasma enhanced chemical vapor deposition process;

depositing a second silicon oxynitride layer on the first silicon oxynitride layer with a second plasma enhanced chemical vapor deposition process;

wherein the first plasma enhanced chemical vapor deposition process having a first power and a first pressure, the second plasma enhanced chemical vapor deposition process having a second power and a second pressure, the second power higher than the first power, the second pressure higher than the first pressure.

26. The method of claim 25 wherein the substrate comprises one selected from a group consisting of polymer, ceramic, carbon composite, Kapton, black Kapton, aluminum, aluminum alloy, silver, gold, platinum, titanium.

27. The method of claim 26 wherein the first power ranges from 25 W to 250 W, the first pressure ranges from 100 mTorr to 2000 mTorr.

28. The method of claim 27 wherein the second power ranges from 250 W to 500 W, the second pressure ranges from 1000 mTorr to 2000 mTorr.

29. The method of claim 28 wherein the first power equals 150 watts, the first pressure equals 1200 mTorr.

30. The method of claim 29 wherein the second power equals 325 watts, the second pressure equals 1600 mTorr.

31. An optical solar reflector for providing environmental stability and mechanical integrity in space, the reflector comprising:

a substrate;

a reflection layer;

a first silicon oxynitride layer on the reflection layer, the first silicon oxynitride layer having a tensile stress;

a second silicon oxynitride layer on the first silicon oxynitride layer, the second silicon oxynitride layer having a compressive stress.